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Cottonwood An American Wood

Two species of cottonwood trees in the United States are commercially important: eastern cottonwood and black cottonwood. Eastern cottonwood is the more important of these. Wood of both species is similar in appearance and properties, being light in weight and color with a fairly straight grain and uniform texture. It is not strong and decays rapidly in damp areas or when in contact with soil. It is used principally for lightweight containers or those requiring an absence of odor or taste, and for interior parts of furniture, core stock in plywood, and high-grade pulp for paper production.

Cottonwood

(*Populus deltoides* Bartr. ex Marsh. and *P. trichocarpa* Torr. & Gray)

Harvey E. Kennedy, Jr. [1]

Distribution

Cottonwood is the general name used for about a dozen closely related trees native to the United States. However, of these only eastern cottonwood and black cottonwood are commercially important for timber production.

Eastern cottonwood (*Populus deltoides*) grows in every State, except Maine, Massachusetts, and Delaware, from the Great Plains eastward (fig. 1), mostly on river bottom lands, rarely in the mountains. Commercially, it is most important along the Mississippi River and its major tributaries.

Black cottonwood, *Populus trichocarpa*, largest of the American species of *Populus* grows along the Pacific Coast from Kodiak Island and Kenai Peninsula through southeastern Alaska to northern California (fig 2). It is also found along the Coast Ranges and Sierra Nevada to southern California and northern Mexico. Inland its range extends southeastward from northwest British Columbia to south-central Montana, central Idaho, and mountains in northwestern Wyoming, northern Utah, and Nevada. It grows chiefly on bottom lands, along stream banks, and in forest meadows.

There are several other species and varieties of cottonwoods, but none of these are of much commercial significance. Fremont cottonwood (*P. fremontii)* grows in the Southwest; a variety (*P. fremontii* var. *wislizeni*), is found along streambanks and in valleys at altitudes of 2,500 to 7,000 feet in the Trans-Pecos region of Texas, along the Rio Grande River, north into New Mexico, southern Colorado, and southern Utah. Both the plains (*P. deltoides* var. *occidentalis*) and narrowleaf (*P. angustifolia*) cottonwoods

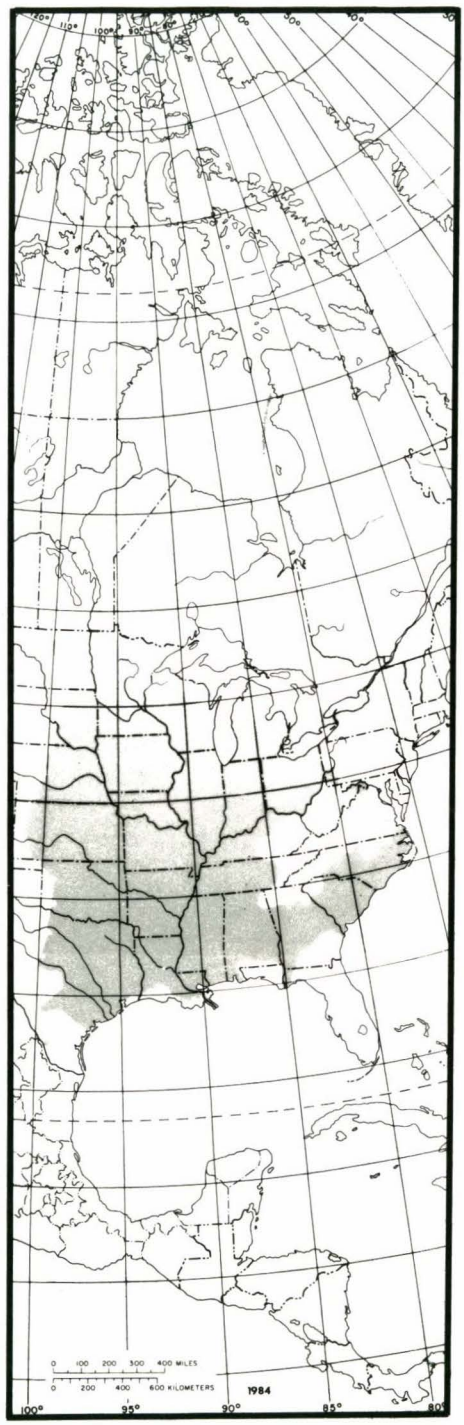

Figure 1—Range of eastern cottonwood.

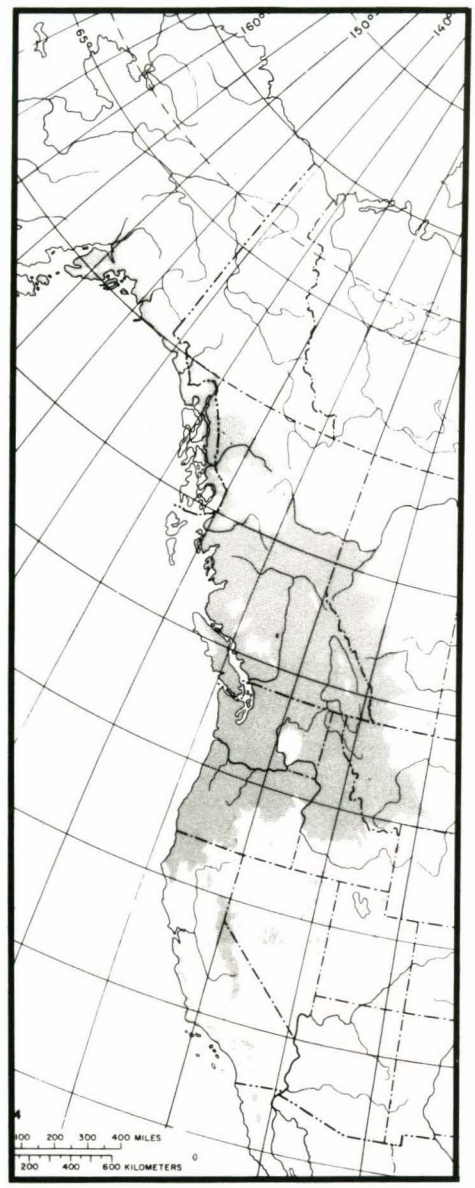

Figure 2—Natural range of black cottonwood.

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are widely distributed in southern Alberta and in most States west of the Great Plains except in the Southwest. Swamp cottonwood (*P. heterophylla*) is found in very wet sites and in swamps of the Atlantic Coastal Plain from Connecticut to Georgia and in small, wet patches elsewhere in the South. Swamp cottonwood also grows in southeastern Missouri, southern Illinois, northern and southern Indiana, part of Ohio, and locally in southern Michigan.

Description and Growth

Eastern cottonwood is the fastest growing native tree in North America. In well-stocked, natural stands in the Mississippi Valley, trees average 20 inches in diameter at breast height (4½ feet) and 130 feet tall at age 35. On good sites they grow to a height of 175 to 190 feet with a diameter of 4 to 6 feet in mature stands 55 to 65 years of age. Trees on good sites often grow 0.7 to 1 inch in diameter and 4 to 5 feet per year in height until they are 25 to 30 years old. Unmanaged stands may yield about 40 cords per acre of pulpwood at age 15 years, but stands with as much as 40,000 board feet per acre at age 55 have been encountered. Managed cottonwood plantations have produced up to 5,200 cubic feet per acre at age 15.

Eastern cottonwood grows primarily on alluvial soils of the bottom lands (fig. 3). It grows best on well-drained sandy loam soils where there is a year-round abundance of soil moisture but not flooding, except possibly for short periods early in the growing season. Natural stands and plantations have withstood flooding as high as 6 feet for 2.5 months during the dormant and early growing season. Flooding during the first growing season causes moderate to severe mortality. In the lower Mississippi River Valley, the best sites are in the batture, the land between the levees and the river. On slopes eastern cottonwood grows only in the lower areas that remain moist throughout the growing season.

Figure 3–Eastern cottonwood, the fastest growing native tree in North America.

Eastern cottonwood is the key species in the Cottonwood Type of forest classification as used by the Society of American Foresters, and it grows chiefly in pure stands or in mixture with black willow. Occasionally it grows singly, or in small groups in forest openings.

Seed production starts in natural stands when trees are about 10 years old, reaching an optimum level around age 30. Planted and cultivated plantations on southern bottom lands begin seeding at age 4 or 5. Good seed crops occur nearly every year. Seed crop failures, which are rare, may result from freez-

ing after flower buds have begun to open. Seed dispersal is from mid-May until late August.

Seedlings and young stands are very intolerant of competition and will not survive unless kept free of vegetation that could overtop them.

Black cottonwood, the largest hardwood tree in the Pacific Northwest, grows mostly in bottom lands, river bars, forest meadows, and streambanks on a variety of soils ranging from moist gravels and sands to rich humus and occasionally clay. For best development it requires abundant moisture, nutrients, and oxygen, combined with a soil pH between 6.0 and 7.0. It grows at elevations from sea level up to 2,000 feet in the northern part of its range, but as high as 7,000 feet in valleys of the Selkirk Mountains in southern British Columbia and 9,000 feet in California.

Black cottonwood is the key species in both the Black Cottonwood–Willow Type and the Cottonwood-Willow Type of the Society of American Foresters system of forest classification. In the first, it is usually pure or predominant, but arborescent willows (*Salix* spp.) may predominate locally. In the Cottonwood–Willow Type, black cottonwood is typically mixed with other cottonwoods and willows. Associates include water birch (*Betula occidentalis*), thinleaf alder (*Alnus tenuifolia*), boxelder (*Acer negundo*), and sycamore (*Plantanus occidentalis*). Black cottonwood grows in mixtures with Douglas-fir (*Pseudotsuga menziesi*), western white pine (*Pinus monticola*), western larch (*Larix occidentalis*), western redcedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), and white fir (*Abies concolor*).

Times of flowering and fruit ripening vary according to altitude and geographic location. Annual seed crops are usually prolific, and dispersal may begin at any time from late May to early June. Seed is highly viable, and good germination results if seeds fall on bare, moist seedbeds. Seedlings and young stands, like those of other cottonwoods, must be kept free of competing vegetation to survive. Early growth on good sites is rapid, and dominant seedlings have attained diameter of 6.7 inches and height of 48.5 feet in 9 years.

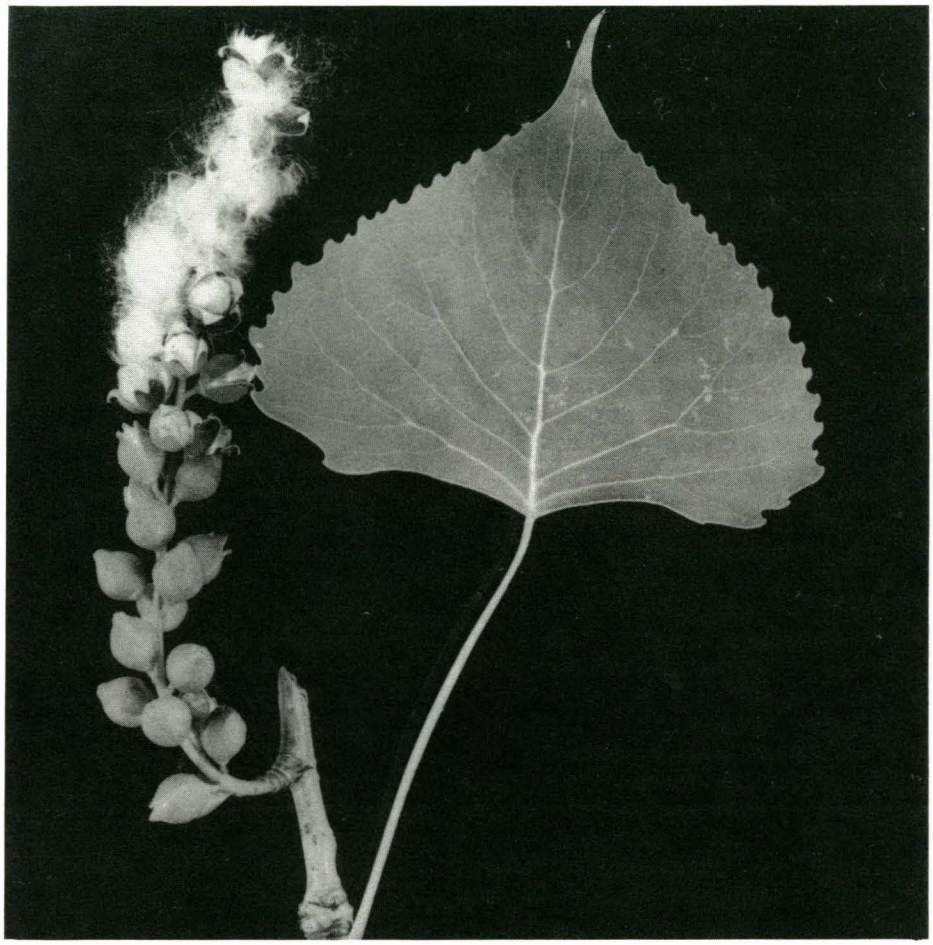

Figure 4—Fruit cluster and leaf of eastern cottonwood

Black cottonwood trees reach maturity at 60 to 75 years. Size at maturity varies considerably. In Inyo County, California, the maximum diameter at breast height is 24 inches with a height of 60 feet, but in Montana, trees on loamy soils are only 12.8 inches in diameter and 45 feet tall at 82 years. Growth and yield per acre are good. A net volume of 27,800 board feet (British Columbia log rule) at an age of 60 years was reported for black cottonwood in the Skeen River Valley, BC. This was a mean annual increment of 463 board feet per acre.

Male and female flowers of both eastern and black cottonwood are borne on separate trees and appear before or just as the leaves emerge. Staminate catkins of both species are 1.5 to 2 inches long, about 0.5 inch wide, and densely flowered. Leaves of both species are alternate and generally deltoid (fig. 4). Bark of eastern cotton-

wood on young branches or trunks is thin and smooth, green to yellow. On older trunks it is gray to black with broad, flattened ridges. Black cottonwood bark is tawny yellow to gray on young stems, but ashy gray on older ones. On mature trees bark is deeply divided into broad, rounded, narrow-topped ridges (fig. 5).

Common Names

Eastern cottonwood is also called eastern poplar, southern cottonwood, Carolina poplar, necklace poplar. Other names for black cottonwood are California poplar, balsam cottonwood, and western balsam poplar.

Related Commercial Species

The aspens (*Populus tremuloides* and *P. grandidentata*) and balsam poplar (*Populus balsamifera*) belong to the same genus as cottonwoods. In most forest resource bulletins, cottonwood and aspen resource estimates are grouped together. Except in the South, western and central Washington, the California coast, and the Alaskan coast, aspen would comprise the bulk of the cottonwood-aspen resource estimates.

Supply

Forest survey reports usually combine the volumes of cottonwood and aspen: therefore, it is difficult to estimate accurately the total volume of sawtimber-size cottonwood available in the United States. The most recent estimate of the available supply of eastern cottonwood (1977), after eliminating aspen, was about 4.8 billion board feet, about half of which is in the South. This figure is about 800 million board feet higher than estimated in 1963, but about 200 million board feet lower than in 1945. The reduction from 1945 to 1963 resulted from stabilization measures effected on major rivers. Stabilization has resulted in less formation of accretion land where cottonwood has always been a pioneer species to form new stands.

Figure 5—Bark of mature black cottonwood.

It has also resulted in less flooding so that layers of silt, which created an ideal bed for the seeding of new stands, are no longer deposited. The increase from 1963 to 1977 probably resulted from existing stands growing to timber with a larger average size, and some commercial cottonwood plantations (fig. 6) growing to sawtimber size. Plantation acreage is now in excess of 50,000 acres with plans to plant another 140,000 to 150,000 acres.

Black cottonwood sawtimber volume in 1963 was estimated at 750 million board feet, excluding aspen, an increase of 50 million board feet over 1945. In 1977, estimated black cottonwood sawtimber volume was 825 million board feet, an increase of 75 million board feet since 1963. Cutting in the western stands has increased appreciably only in recent years. This increase in available supply may be due to younger stands growing timber of

Figure 6—Southern plantation of eastern cottonwood grown to minimum pulpwood size in 4 years.

larger average diameter, and some additional stands may have become merchantable during the 14-year period.

Production

Production figures for cottonwood have varied greatly since 1900. From a maximum output of over 421 million board feet in 1899, output declined to about 49 million board feet in 1932. Production then increased to a volume of slightly over 174 million board feet in 1960. Apparently, production then declined again; data from the Southern Hardwood Lumber Manufacturers Association indicated total production of cottonwood to be 125 million board feet in 1970. The same source showed annual production of 170 to 180 million board feet for aspen species in the United States.

Production of eastern cottonwood pulpwood in Mississippi Valley was 35,000 cords in 1968, 73,000 cords in 1969, 100,000 cords in 1970. Production was expected to be 118,000 cords in 1971. This trend of increased pulpwood production is expected to continue.

A sizable volume of logs is also used in production of veneer and plywood. It is difficult to obtain accurate volumes for use in comparing present and past production, but the recent trend seems to have been a steady decrease since 1950. The Southern Hardwood Lumber Manufacturers Association believes that use of veneer logs may have dropped to as low as 25 million board feet annually by 1966. Reports for 1960 showed production of about 205 million square feet surface measure of cottonwood veneer, roughly 85 percent of which went into containers.

In 1960, a total of slightly over 2 million square feet surface measure of plywood was used by industries. About one-third of this was used by the luggage industry; rubber and manufacture of miscellaneous plastic products consumed another one-third. Another million board feet of cottonwood bolts were used in 1960 by special products sawmills, probably in the manufacture of furniture and millwork products.

Characteristics and Properties

The heartwood of both eastern and black cottonwood is brownish colored, although black cottonwood is somewhat lighter. Sapwood varies in width, is a whitish color in both species, and is not clearly defined from the heartwood. Cottonwood is a diffuse-porous hardwood; the annual rings are not conspicuous, but they can be distinguished. The wood of both species is moderately light in weight; 24 pounds per cubic foot at 12 percent moisture content for black, and 28 pounds per cubic foot for eastern cottonwood. The specific gravity, based on green volume and ovendry weight is 0.31 for black cottonwood and 0.37 for eastern cottonwood.

Eastern cottonwood is moderately weak in bending and in compression, moderately soft, and relatively low in ability to resist shock. Black cottonwood rates below eastern cottonwood in strength properties. Neither species is durable under conditions favorable to decay.

Cottonwood lumber is prone to warping, but shrinkage is moderate. It glues satisfactorily, has low nail-holding ability, does not split easily, and holds paint well. It has a sour odor when moist, but it is odorless and tasteless when dry.

The wood is easily made into a highly desirable grade of paper pulp. Because

the wood of both species is light colored, it requires little bleaching during pulping.

The principal disadvantage associated with cottonwood is the frequent presence of gelatinous fibers in what is known as "tension wood." The presence of tension wood results in a fuzzy surface when the logs are sawed into lumber or cut into veneer. It also causes buckling of veneer as soon as it is cut and abnormally shrinks, during drying, causing further buckling and warping. "Wet wood" is an undesirable condition caused by bacterial infection, which may cause problems in drying.

Principal Uses

Cottonwood is utilized in several different classes of materials: lumber, veneer, plywood short bolts, and pulpwood. Lumber and veneer go mainly into nailed and wirebound wood boxes and crates. Cottonwood is preferred for many food containers and packaging cases because of its light weight, freedom from odor and taste, and light color, which makes stenciling easy. The use of cottonwood for containers is predicted to increase if suitable wood is available. The lumber and veneer are also used for interior parts of furniture; plywood, both core stock and face veneer; agricultural implements; and woodenware, including cutting boards, meat boards, and a variety of fixtures produced in millwood plants. The use of cottonwood for furniture is fairly constant, with a trend toward increased use. Some veneer is used in match production.

Cottonwood bolts are used principally by special products sawmills to produce numerous small articles and prefabricated furniture parts. Wider use of cottonwood in the manufacture of exterior parts of furniture is expected in the future. The wood is too soft to use naturally in exterior parts, but special surface treatment and impregnations may remove this limitation.

Use of cottonwood pulpwood is increasing because of rapidly expanding demand for pulp, especially in the manufacture of high-grade book and magazine paper, and is expected to increase. This increasing use is causing intense competition for stumpage in the South and fostering extensive planting ventures. This in turn is bringing better utilization of harvested timber by encouraging the removal of more wood from the tops of trees.

Shifting rivers undercut cottonwood trees along their banks. Trees lodge as they fall into the rivers and may remain for many years before being released by subsequent river changes. Wood of these trees is sound and has a pleasing blue-gray color. Solid wood paneling and trim from these logs, sold as "blue cottonwood," is prefinished for use in homes and offices, but the supply is limited.

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